**Citation:**

Neumark-Sztainer D, Wall M, Haines J, Story M, Eisenberg ME. Why does dieting predict weight gain in adolescents? Findings from project EAT-II: a 5-year longitudinal study. *J Am Diet Assoc.* 2007 Mar;107(3):448-55.

**PubMed ID:** 17324664

**Study Design:**

Prospective Cohort Study

**Class:**

B - Click here for explanation of classification scheme.

**Research Design and Implementation Rating:**

NEUTRAL: See Research Design and Implementation Criteria Checklist below.

**Research Purpose:**

- To examine longitudinal associations between dieting and behaviors commonly promoted for healthful weight management, including decreased binge eating, increased frequency of breakfast consumption, increased fruit and vegetable intake and increased moderate-to-vigorous physical activity.
- To test a model to explain longitudinal associations between dieting and change in BMI over a 5-year period.

**Inclusion Criteria:**

- Middle school and high school students from Minnesota who completed surveys for both the Project EAT-I and Project EAT-II

**Exclusion Criteria:**

- Middle school and high school students who completed surveys for Project EAT-I who were lost to follow-up before Project EAT-II due to missing contact information or no address found at follow-up
- Participants in Project EAT-I that declined to participate in Project EAT-II

**Description of Study Protocol:**

**Recruitment**

Middle and high school students from 31 Minnesota schools completed in-class surveys and anthropometric measurements during the 1998-1999 academic year.

**Design:** Population-based, 5-year prospective cohort study

**Blinding used (if applicable):** not applicable

**Intervention (if applicable):** not applicable

**Statistical Analysis**

Bivariate associations between dieting at Time 1 and each of the four potential mediating behaviors at Time 2 were examined using for separate linear regression models followed by four multiple regressions adjusted for confounders.

**Data Collection Summary:**

**Timing of Measurements**

Participants completed in-class surveys and anthropometric measurements during the 1998-1999 school year for Project EAT-I. Participants completed mailed surveys 5 years following the initial survey (2003-2004) for Project EAT-II.

**Dependent Variables**

- Change in BMI between Project EAT-I and Project EAT-II surveys
- Self-reported binge eating on Project EAT-II survey
- Self-reported frequency of breakfast consumption on Project EAT-II survey
- Self-reported fruit and vegetable intake on Project EAT-II survey
- Self-reported moderate-to-vigorous physical activity on Project EAT-II survey

**Independent Variables**

- Self-reported "dieting," defined as changing the way that the participants eats in order to lose weight, during the year preceding Project EAT-I data collection

**Control Variables**

- Sociodemographic characteristics reported on Project EAT-I survey

**Description of Actual Data Sample:**

**Initial N**: 4,746 participants (44.9% male)

**Attrition (final N):** All 2,516 participants completed both the Project EAT-I and Project EAT-II surveys

**Age**: One-third of the participants were in the younger cohort with a mean age of 12.8 ± 0.8 years at completion of the Project EAT-I survey and a mean age of 17.2 ± 0.6 years at the completion of the Project EAT-II survey. Two-thirds of the participants were in the older cohort with a mean age of 15.8 ± 0.8 years at the completion of the Project EAT-I survey and a mean age of 20.4 ± 0.8 years at the completion of the Project EAT-II survey.

**Ethnicity**: 48.3% white, 18.9% African American, 5.8% Hispanic, 19.6% Asian, 3.6% Native American and 3.8% mixed race or other.

**Other relevant demographics**: 17.8% low socioeconomic status, 18.9% middle-low, 26.7% middle, 23.3% middle-high and 13.3% high

**Anthropometrics** Not reported

**Location**: Minnesota, United States

**Summary of Results:**

**Key Findings**

- In female participants, self-reported dieting on Project EAT-I survey was associated with increased binge eating (P < 0.001), decreased frequency of breakfast consumption (P = 0.030) and decreased fruit and vegetable intake on the Project EAT-II survey. The pattern remained similar when adjusted for sociodemographic characteristics and weight classification at the time of the initial survey, although the association between dieting and fruit and vegetable intake was no longer significant.
- In male participants, self-reported dieting on Project EAT-I survey was associated with increased binge eating (P < 0.001), decreased frequency of breakfast consumption (P = 0.064) and decreased moderate-to-vigorous physical activity (P = 0.006) on the Project EAT-II survey. Patterns remained similar in adjusted analyses.
- In female participants, dieters gained 0.69 ± 0.21 BMI units more than non-dieters (P=0.001). The association between dieting and BMI change remained statistically significant even after adjustment for the behaviors of binge eating, breakfast consumption, fruit and vegetable intake and physical activity (dieters gained 0.53 ± 0.21 BMI units more than non-dieters; P=0.014).
- In male participants, dieters gained 0.77 ± 0.26 BMI units more than non-dieters (P=0.003). The association between dieting and BMI change remained significant after adjusting for eating and activity behaviors with dieters gaining 0.62 ± 0.26 BMI units more than non-dieters (P=0.016).

**Eating and Activity Behaviors Reported on Project EAT-II Survey by dieting behavior at Project EAT-I Survey in Female Adolescents**

| | n | Binge Eating<br>% ± SE | Breakfast (times/wk)<br>Mean ± SE | Fruit/Vegetable Intake (servings/wk)<br>Mean ± SE | Physical Activity (h/wk)<br>Mean ± SE |
|---|---|---|---|---|---|
| Bivariate Analysis | | | | | |
| No Dieting | 601 | 10.19 ± 1.51 | 3.58 ± 0.10 | 3.64 ± 0.09 | 4.30 ± 0.16 |
| Dieting | 779 | 20.59 ± 1.30 | 3.15 ± 0.09 | 3.40 ± 0.08 | 4.10 ± 0.13 |
| P value | | <0.001 | 0.001 | 0.049 | 0.331 |
| Adjusted Analysis[a] | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| No Dieting | 601 | 11.34 ± 1.57 | 3.55 ± 0.10 | 3.59 ± 0.09 | 4.21 ± 0.16 |
| Dieting | 779 | 20.23 ± 1.40 | 3.24 ± 0.09 | 3.42 ± 0.08 | 4.21 ± 0.14 |
| P value | | <0.001 | 0.030 | 0.156 | 0.979 |

[a] *Analyses adjusted for socioeconomic status, race, age, cohort and Project EAT-I weight status*

**Eating and Activity Behaviors Reported on Project EAT-II Survey by dieting behavior at Project EAT-I Survey in Male Adolescents**

| | **n** | **Binge Eating**<br>**% ± SE** | **Breakfast (times/wk)**<br>**Mean ± SE** | **Fruit/Vegetable Intake (servings/wk)**<br>**Mean ± SE** | **Physical Activity (h/wk)**<br>**Mean ± SE** |
|---|---|---|---|---|---|
| Bivariate Analysis | | | | | |
| No Dieting | 841 | 4.97 ± 0.90 | 3.39 ± 0.09 | 3.05 ± 0.08 | 6.89 ± 0.17 |
| Dieting | 278 | 14.0 ± 1.51 | 2.95 ± 0.15 | 3.06 ± 0.13 | 5.58 ± 0.28 |
| P value | | <0.001 | 0.012 | 0.955 | <0.001 |
| Adjusted Analysis[a] | | | | | |
| No Dieting | 841 | 4.11 ± 0.87 | 3.41 ± 0.09 | 3.11 ± 0.08 | 6.97 ± 0.17 |
| Dieting | 278 | 11.83 ± 1.60 | 3.05 ± 0.17 | 3.22 ± 0.15 | 5.95 ± 0.32 |
| P value | | <0.001 | 0.064 | 0.548 | 0.006 |

[a] *Analyses adjusted for socioeconomic status, race, age, cohort and Project EAT-I weight status*

**Author Conclusion:**

- Associations between dieting and BMI change were weakened when behaviors were included in the model but remained significant. The difference in coefficient of change between the model that included the eating and activity behaviors and the model that did not include these behaviors was significant indicating that the association between dieting and BMI change was partially mediated by the eating/activity behaviors included in the model testing.
- The analysis does not fully explain why dieting predicts weight gain over time. Other hypotheses including that dieting leads to greater metabolic efficiency or that dieters are more prone to developing obesity beyond any risk that is addressed by adjusting for baseline BMI need to be explored.

***Reviewer Comments:***

- *Attrition in the study population between surveys was not equally distributed across sociodemographic characteristics. To compensate the data were weighted using the response propensity method so that estimates would be generalizable to a population with the demographic makeup of the original Project EAT sample.*
- *Participants that did not complete a Project EAT-II survey differed from participants that completed both surveys in than male participants who reported binge eating at baseline were less likely to complete a Project EAT-II survey and female participants with lower self-reported moderate-to-vigorous physical activity were less likely to complete a Project EAT-II survey.*
- *All data collected in the Project EAT-II survey were self-reported including weight.*

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***Research Design and Implementation Criteria Checklist: Primary Research***

| **Relevance Questions** | | |
|---|---|---|
| 1. | Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies) | N/A |
| 2. | Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about? | Yes |
| 3. | Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice? | Yes |
| 4. | Is the intervention or procedure feasible? (NA for some epidemiological studies) | N/A |

| **Validity Questions** | | |
|---|---|---|
| **1.** | **Was the research question clearly stated?** | Yes |
| 1.1. | Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified? | Yes |
| 1.2. | Was (were) the outcome(s) [dependent variable(s)] clearly indicated? | Yes |
| 1.3. | Were the target population and setting specified? | Yes |
| **2.** | **Was the selection of study subjects/patients free from bias?** | ??? |
| 2.1. | Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study? | Yes |
| 2.2. | Were criteria applied equally to all study groups? | Yes |

| | | |
|---|---|---|
| 2.3. | Were health, demographics, and other characteristics of subjects described? | Yes |
| 2.4. | Were the subjects/patients a representative sample of the relevant population? | ??? |
| **3.** | **Were study groups comparable?** | Yes |
| 3.1. | Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT) | Yes |
| 3.2. | Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline? | Yes |
| 3.3. | Were concurrent controls used? (Concurrent preferred over historical controls.) | N/A |
| 3.4. | If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis? | Yes |
| 3.5. | If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.) | N/A |
| 3.6. | If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")? | N/A |
| **4.** | **Was method of handling withdrawals described?** | Yes |
| 4.1. | Were follow-up methods described and the same for all groups? | Yes |
| 4.2. | Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.) | Yes |
| 4.3. | Were all enrolled subjects/patients (in the original sample) accounted for? | Yes |
| 4.4. | Were reasons for withdrawals similar across groups? | Yes |
| 4.5. | If diagnostic test, was decision to perform reference test not dependent on results of test under study? | N/A |
| **5.** | **Was blinding used to prevent introduction of bias?** | No |
| 5.1. | In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate? | N/A |
| 5.2. | Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.) | N/A |

| | | |
|---|---|---|
| 5.3. | In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded? | No |
| 5.4. | In case control study, was case definition explicit and case ascertainment not influenced by exposure status? | N/A |
| 5.5. | In diagnostic study, were test results blinded to patient history and other test results? | N/A |
| **6.** | **Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?** | Yes |
| 6.1. | In RCT or other intervention trial, were protocols described for all regimens studied? | N/A |
| 6.2. | In observational study, were interventions, study settings, and clinicians/provider described? | Yes |
| 6.3. | Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect? | Yes |
| 6.4. | Was the amount of exposure and, if relevant, subject/patient compliance measured? | N/A |
| 6.5. | Were co-interventions (e.g., ancillary treatments, other therapies) described? | N/A |
| 6.6. | Were extra or unplanned treatments described? | N/A |
| 6.7. | Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups? | N/A |
| 6.8. | In diagnostic study, were details of test administration and replication sufficient? | N/A |
| **7.** | **Were outcomes clearly defined and the measurements valid and reliable?** | ??? |
| 7.1. | Were primary and secondary endpoints described and relevant to the question? | Yes |
| 7.2. | Were nutrition measures appropriate to question and outcomes of concern? | Yes |
| 7.3. | Was the period of follow-up long enough for important outcome(s) to occur? | Yes |
| 7.4. | Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures? | No |
| 7.5. | Was the measurement of effect at an appropriate level of precision? | ??? |
| 7.6. | Were other factors accounted for (measured) that could affect outcomes? | Yes |
| 7.7. | Were the measurements conducted consistently across groups? | Yes |
| **8.** | **Was the statistical analysis appropriate for the study design and type of outcome indicators?** | Yes |

| | | |
|---|---|---|
| 8.1. | Were statistical analyses adequately described and the results reported appropriately? | Yes |
| 8.2. | Were correct statistical tests used and assumptions of test not violated? | Yes |
| 8.3. | Were statistics reported with levels of significance and/or confidence intervals? | Yes |
| 8.4. | Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)? | N/A |
| 8.5. | Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)? | Yes |
| 8.6. | Was clinical significance as well as statistical significance reported? | Yes |
| 8.7. | If negative findings, was a power calculation reported to address type 2 error? | N/A |
| **9.** | **Are conclusions supported by results with biases and limitations taken into consideration?** | Yes |
| 9.1. | Is there a discussion of findings? | Yes |
| 9.2. | Are biases and study limitations identified and discussed? | Yes |
| **10.** | **Is bias due to study's funding or sponsorship unlikely?** | Yes |
| 10.1. | Were sources of funding and investigators' affiliations described? | Yes |
| 10.2. | Was the study free from apparent conflict of interest? | Yes |